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Analysis of Picattiny Sample for Trace Explosives

G.L. Klunder, R. Whipple, L. Carman, P. E. Spackman, J.G. Reynolds, A. Alcaraz

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Rich Whipple
Leslie Carman
Paul Spackman
Armando Alcaraz
John Reynolds
Greg Klunder

Forensic Science Center
Lawrence Livermore National Laboratory
P.O. Box 808, L-091
Livermore, CA 94551

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Lawrence Livermore National Laboratory P.O. Box 808, Livermore, CA 94551-0808

EXECUTIVE SUMMARY

The sample received from Picatinny Arsenal was analyzed for trace amounts of high explosives (HE). A complete wash of the surface was performed, concentrated, and analyzed using two sensitive analysis techniques that are capable of detecting numerous types of explosives. No explosives were detected with either test.

BACKGROUND

Picatinny Arsenal requested the analysis of a sample for trace levels of high explosives with the focus on military type explosives. The sample was received on May 1, 2008 and entered into the Forensic Science Center log book, photographed and screened for radioactivity. The sample was approximately 4 cm x 9 cm (photos below) and covered with rust with a tip that was of a different non-ferrous material.

Figure 1. Photos of the Picatinny Sample, dimensions in cm.

EXPERIMENTAL APPROACH

Due to the nature of the sample's rusty surface, it was decided to do a surface extraction by soaking the part in acetone. The part in question was worked up by soaking it in approximately 200 - 220 mL acetone overnight. The part was removed and the acetone was then reduced in volume with gentle nitrogen flow to approx. 50 mL and an aliquot was analyzed using the ELITE colorimetric test (Field Forensics, Inc.). The ELITE provides a sensitive (50ng limits of detection) screening for classes of explosives but does not provide identification of specific explosives.

The volume was reduced further to approx. 4 mL, and another ELITE analysis and a Thin-Layer Chromatography (TLC) analysis were performed. TLC provides a comparable sensitivity to ELITE with the capability to identify specific type of explosives. TLC is a separation technique that allows for detection and identification of explosives. Samples are spotted on a coated glass plate that is dipped in a solvent that wicks up the plate and separates the different components.
The following certified standards were utilized to generate TLC - Retention Factor (Rf) values: TNT (2,4,6-trinitrotoluene), RDX (1,3,5-trinitro-1,3,5-triazacyclohexane), PETN (pentaerythritol tetranitrate), Tetryl (2,4,6-trinitrophenyl-N-methylnitramine), Picric acid, HMX (1,3,5,7-tetranitro-1,3,5,7 tetraazacyclooctane)and NG (Di or tri???nitroglycerin)
The TLC analysis protocol for explosives incorporates two different solvent systems, organic and aqueous based, that reverse the order of the analytes and help provide a method of confirmation and reduces the probability of a false positive result.

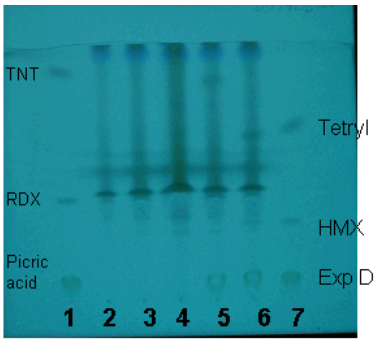
RESULTS AND DISCUSSION

The results from both ELITE tests and the TLC analysis were negative for high explosives. Results from the TLC analysis are shown below. Two explosive standards are spotted on each plate both separately and with the sample as a standard addition. Chemicals appears as spots on the plate with the size and intensity of the spot correlating to the amount present, however, quantitative results were not pursued in this analysis. The TLC plate is viewed and imaged under UV light and after staining with white light. None of the sample spotsmatched the Rf values of the standards utilized, therefore no explosives were detected by TLC.

If explosives were identified in either of the screening tests, a further confirmatory analysis by gas chromatography - mass spectrometry (GC-MS) would have been pursued.

Results from TLC analysis with the organic solvent system

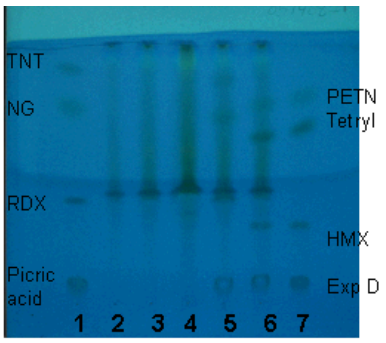
Lane
1. Std 1, 2 µL
2. 051408, 1 µL
3. 051408, 2 x 1 µL
4. 051408, 5 x 1 µL
5. 051408, 2 x 1 µL + Std 1, 2 µL



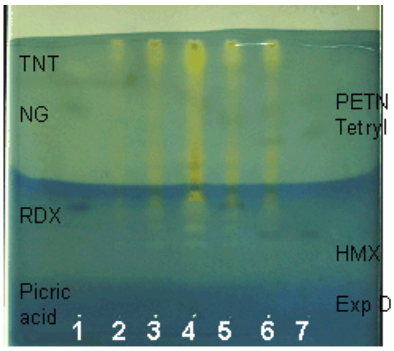
Viewed under UV light, before staining

6. 051408, 2 x 1 µL + Std 2, 2 µL
7. Std 2, µL

Std 1 = Picric Acid, RDX, TNT (100 µg/mL)
NG (200 µg/mL)
Std 2 = Tetryl, HMX, Explosive D (100 µg/mL)



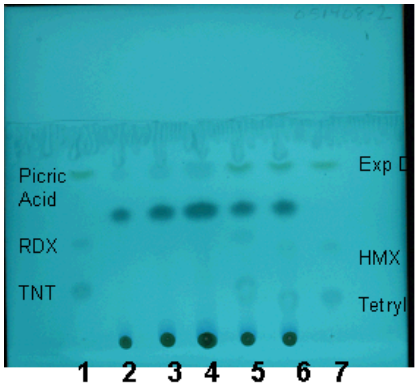
Viewed under UV light, after staining



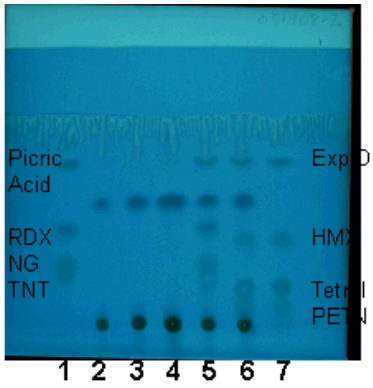
Viewed under white light, after staining

Results from TLC analysis with the aqueous solvent system

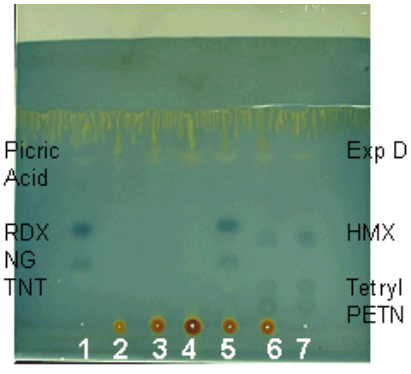
Lane
1. Std 1, 2 µL
2. 051408, 1 µL
3. 051408, 2 x 1 µL
4. 051408, 5 x 1 µL
5. 051408, 2 x 1 µL + Std 1, 2 µL
6. 051408, 2 x 1 µL + Std 2, 2 µL
7. Std 2, 2 µL



Viewed under UV light



Viewed under UV light, after staining



Viewed under white light, after staining